

Survey Methodology

Surveys of the Teton River in the former reservoir inundation area were completed in 1997, 1998 and 1999. This section discusses the logistics and methodology used for each of the surveys, and the conversion of the 1997-98 data collected in a local datum (based on 1972 topography maps) to a modern datum (North American Datum (NAD) '83 and North American Vertical Datum (NAVD) '88). Providing all of the data in a modern datum will allow for consistency in any future comparisons of results from this study to additional data collected in the study area. Documentation of the control network has been provided for this purpose (see table C-12).

The first phase of the hydrographic survey included a field reconnaissance in July 1997 to determine the logistical requirements of working in a remote river canyon with limited access (see table C-1). Based on the field reconnaissance trip, it was determined that the hydrographic survey between Spring Hollow and Canyon Creek, and in the borrow ponds would be conducted during a four-day raft trip in August 1997. In July 1998, supplemental data was collected for the Spring Hollow to Canyon Creek reach, and new data collected in a short reach at RM 4 between Canyon Creek and the borrow ponds. The hydrographic survey between Bitch Creek and Spring Hollow was accomplished in July and September of 1999.

Spring Hollow to Teton Dam Site Reach Survey

For the Spring Hollow to Canyon Creek reach, a survey crew would be needed along the canyon rim to provide survey control to the canyon bottom. An additional survey crew would be needed along the river channel to track the position of a survey raft measuring water surface elevations and channel bottom topography. The survey raft would be equipped with a fathometer (depth sounder), reflective prisms, and a hand-held radio (see photo A-13). Additional support rafts were also required to carry people, equipment, and camping supplies. The logistics of the borrow-pond survey were much easier because there was direct road access, a boat ramp, no rapids to navigate, and the survey crew could stay each night in motels.

Because the study would compare existing and predam conditions, it was originally decided to tie the new survey to the local horizontal and vertical datums used to produce a set of predam 1972 topographic maps of the Teton Reservoir area. Prior to surveying the borrow ponds and the Spring Hollow to Canyon Creek reach in August 1997, the existing survey-control network along the top of the canyon was extended to include new control points along the canyon rim (see table C-2). These new control points were established at strategic locations where there was a clear view of the river channel below.

For the river channel survey, a total station survey instrument was set up over the new survey monuments to periodically measure the position of the survey raft (horizontal and vertical coordinates of the water surface) and measure the edge of water through the pools and rapids (see photo A-14). Bathymetric surveys of each pool were conducted by rowing the survey raft across selected survey lines in each pool. Water depths were measured using the fathometer on the raft and the position of the raft was measured by use of the total-station, survey instrument on shore. From the total-station, the horizontal and vertical angles had to be continuously adjusted

to track the position of the moving raft. After each position of the raft was measured, the point-measurement number was relayed by radio to the raft and the position and point number were marked on the depth chart. This procedure provided horizontal and vertical coordinates of the water surface and, by subtracting the water depth, of the channel bottom.

The survey crew first practiced this procedure in the borrow ponds with the use of a motorized, aluminum survey boat (see table C-3). In the borrow ponds, transverse cross-sections were surveyed along with longitudinal profiles and measurements along the edge of the ponds. In addition to surveying the two ponds, data was also collected through the bypass channel that is parallel to the downstream pond. The survey of the borrow ponds was completed in two days, and the same procedure was applied to the Teton River Canyon between Spring Hollow and Canyon Creek.

During the August 1997 Spring Hollow to Canyon Creek raft trip (see table C-4), survey control along the canyon rim was extended to additional points along the canyon bottom. Monuments (steel rebar with aluminum caps) for the control points along the canyon bottom were installed by the survey party rafting through the canyon. Coordinates for these monuments were measured by the survey crew along the canyon rim. Cross sections in eighteen river pools were measured in the reach between Spring Hollow and Canyon Creek. The cross section locations in each river pool were chosen to represent the river pool geometry and were also determined by the ability to maneuver the boat. Additional survey data included longitudinal profiles of the water surface and channel bottom. The high velocity of the riffles and rapids prevented direct measurements of the channel bottom through these sections. Therefore, channel bottom elevations across the riffle or rapid were estimated through hydraulic modeling. Points along the water's edge through the pool and riffle along with canyon topography were taken by reflecting the total station laser off of the bank or ground surface.

Several gaps between Spring Hollow and Canyon Creek were observed in the data set collected in 1997. A supplemental survey trip was scheduled in July 1998 to fill in these gaps and provide additional survey information in the reach between Canyon Creek and the borrow ponds (see tables 7 and 8). Because this was a supplemental survey, a simpler survey procedure was used. The survey raft for the 1998 trip was equipped similarly to the 1997 survey trip, however, an electronic distance meter (EDM) was used to track the survey raft's position from shore. All survey lines during the 1998 survey were run across the channel (perpendicular to flow). The EDM was set up on shore and near the water's edge at one end of the survey line. The horizontal position of the EDM setup was measured using a hand-held GPS Plugger unit. The horizontal coordinates of the temperature and air data loggers placed during this field trip along the river were also measured using the hand-held GPS PLUGGER unit (Bowser, 1999). The EDM was used to continuously measure the horizontal distance along each survey line. Because the EDM was on the survey line and typically near the water surface elevation, only relatively minor adjustments in the horizontal and vertical angles were

necessary to track the position of the survey raft. As the EDM continuously tracked the distance to the survey raft, the distances, at regular distance intervals, were relayed to the survey raft by radio.

The discharge recorded at the USGS St. Anthony gaging station during the July 1998 survey of 1,220 ft³/s was very similar to the discharge of 1,400 ft³/s recorded during the August 1997 survey in this reach (USGS gaging station 13055000). Because the water surface across each pool was assumed to be level and the discharges for both surveys were similar, the water surface elevations for the 1998 cross section lines were estimated from the average pool water surfaces measured in August 1997. The measured water depths and distance between measurements could then be subtracted from the estimated pool elevation to develop a channel bottom profile for each cross section.

An additional reach of the Teton River was also surveyed at RM 4 in 1998 to document the characteristics of the Teton River from Canyon Creek (RM 5.0) downstream to the borrow ponds (RM 1.5). The surveyed river reach is short (800 ft), and consists of shallow pools and riffles with floodplains on the south side of the canyon. The same methodology as used to supplement the 1997 data upstream of Canyon Creek was used to survey the channel bottom at six cross sections in this reach. Two of the cross sections were located upstream of a riffle, the next two cross sections were located in the riffle, and the last two cross sections were located downstream of the riffle. Additional survey data was collected to document the right floodplain topography at each cross section using a total station instrument.

A longitudinal water surface profile was developed from 1997 measured data from Spring Hollow to Canyon Creek. Water surface elevations tended to rise slightly in the downstream direction, and fluctuated up to ± 1 foot across any transverse line in a pool (see figure 3 in report). In contrast to the measured data, field observations noted that each rapid backs up water to create a pool with a relatively flat water surface with a small slope in the downstream direction. It was determined that the 1 foot vertical fluctuation in water surface elevations across any section of river was due to survey limitations and could not be resolved. When the moving target of the survey raft was being tracked with the total-station, survey instrument, the horizontal angles tended to change much faster than the vertical angles which measure the water-surface elevations of the nearly level pools. Consequently, the vertical angles were not adjusted as frequently as the horizontal angles and some error was introduced in the individual measurements of the water-surface elevation. However, the average water surface elevation in each pool was believed to be accurate.

Table C-1.—Initial Field Reconnaissance from Spring Hollow to borrow ponds.

Dates: July 21, 1997
Participants: Dick Bauman (Environmental Specialist, USBR Snake River Area Office East, Jackson, WY) Cory Stolsig (Supervisory Land Surveyor, USBR Ephrata Office, Ephrata, WA) Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO) Dean Ostenaar (Geologist, USBR Technical Service Center, Denver, CO) Ralph Klinger (Geologist, USBR Technical Service Center, Denver, CO) Allen Lockhart (Geologist, USBR Pacific Northwest Regional Office, Boise, ID) Bill Schrader (Fishery Biologist, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID) Kim Ragotzkie (Biologist, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID) Steve Lipscomb (Hydrologist, USGS, Boise, ID) Nathan Jacobson (Hydrologist, USGS, Idaho Falls, ID)

Table C-2.—Survey to extend existing control network to the canyon rim.

Dates: August 4-8, 1997
Participants: Cory Stolsig (Supervisory Land Surveyor, USBR Ephrata Office, Ephrata, WA) survey party chief Sam Trachsler (Surveyor, USBR Ephrata Office, Ephrata, WA) survey crew Doug Schmidt (Materials Engineering Technician, USBR Ephrata Office, Ephrata, WA) survey crew Irving Lawyer (Engineering Technician, USBR Pacific Northwest Regional Office, Boise, ID) survey crew
Equipment: Total station survey instruments

Table C-3.—Hydrographic survey of borrow ponds.

Dates: August 9-10, 1997
River flow at USGS gaging station near St. Anthony, Idaho (13055000): <u>1,200 ft³/s</u>
Participants: <ul style="list-style-type: none"> • Cory Stolsig (Supervisory Land Surveyor, USBR Ephrata Office, Ephrata, WA) survey party chief • Doug Schmidt (Materials Engineering Technician, USBR Ephrata Office, Ephrata, WA) survey crew • Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), fathometer operator • Bill Schrader (Fishery Biologist, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID), boat pilot
Equipment: <ul style="list-style-type: none"> • Aluminum boat (Idaho Department of Fish and Game, Idaho Falls, ID) • Total station survey instrument (USBR Ephrata Office, Ephrata, WA) • Raytheon Fathometer (USBR Technical Service Center, Denver, CO)

Table C-4.—Hydrographic survey of river channel from Spring Hollow to Canyon Creek.

Survey task: Hydrographic survey of river channel from Spring Hollow to Canyon Creek.
Dates: August 11-14, 1997
River flow at USGS gaging station near St. Anthony, Idaho (13055000): <u>1,400 ft³/s</u>
<p>Participants:</p> <ul style="list-style-type: none"> • Dick Bauman (Environmental Specialist, USBR Snake River Area Office East, Jackson, WY) Area Office Study Leader and boat pilot • Cory Stolsig (Supervisory Land Surveyor, USBR Ephrata Office, Ephrata, WA) survey party chief and instrument operator in the canyon • Sam Trachsler (Surveyor, USBR Ephrata Office, Ephrata, WA) survey crew along canyon rim • Irving Lawyer (Surveyor, USBR Pacific Northwest Regional Office, Boise, ID) survey crew along canyon rim • Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), fathometer operator • Bill Schrader (Fishery Biologist, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID), boat pilot • Jason Hammond (Biological Aid, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID), boat pilot
<p>Equipment:</p> <ul style="list-style-type: none"> • Large inflatable raft (Snake River Area Office East, Jackson, WY) • Small inflatable raft (Idaho Department of Fish and Game, Idaho Falls, ID) • Catoraft (rented in Idaho Falls by Snake River Area Office East, Jackson, WY) • Total station survey instrument (USBR Ephrata Office, Ephrata, WA) • Handheld radios (USBR Ephrata Office, Ephrata, WA) • Raytheon Fathometer (USBR Technical Service Center, Denver, CO) • Portable generator, and other miscellaneous supplies (USBR Technical Service Center, Denver, CO)

Table C-5.—Field Reconnaissance from Felt Dam Powerhouse to Spring Hollow.

Dates: July 20, 1998
River flow at USGS gaging station near St. Anthony, Idaho (13055000): <u>1,290 ft³/s</u>
Participants: <ul style="list-style-type: none">• Dick Bauman (Environmental Specialist, USBR Snake River Area Office East, Jackson, WY) Area Office Study Leader and boat pilot• Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO) survey leader and EDM operator• Jennifer Bountry (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), fathometer operator• Ralph Klinger (Geologist, USBR Technical Service Center, Denver, CO), geomorphic mapping• Allen Lockhart (Geologist, USBR Pacific Northwest Regional Office, Boise, ID), landslide debris fans measurements• Steven Bowser (Environmental Engineer, USBR Technical Service Center, Denver, CO), installation of temperature (air and water) data loggers• T. Ed Beddow (Wildlife Biologist, USBR Technical Service Center, Denver, CO), vegetation mapping• Joe Curry (District Conservation Officer, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID)• John Hanson (Conservation Officer, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID)• Mike Jones (Fishery Technician, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID)• Doug Petersen (Conservation Officer, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID)• Bill Schrader (Fishery Biologist, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID)• Brian Spicer (Biological Aid, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID)• Greg Tourtlotte (Regional Supervisor, Idaho Department of Fish and Game, Panhandle Region, Coeur d' Alene, ID)
Equipment: <ul style="list-style-type: none">• Large inflatable raft (Snake River Area Office East, Jackson, WY)• Large inflatable raft (USBR Technical Service Center, Denver, CO)• Large inflatable raft (Idaho Department of Fish and Game, Idaho Falls, ID)• Small inflatable raft (Idaho Department of Fish and Game, Idaho Falls, ID)

Table C-6.—Supplemental hydrographic survey of river channel from Spring Hollow to Canyon Creek and downstream of Canyon Creek at RM 4.

Dates: July 20-23, 1998
River flow at USGS gaging station near St. Anthony, Idaho (13055000): average of <u>1,220 ft³/s</u>
Participants: <ul style="list-style-type: none"> • Dick Bauman (Environmental Specialist, USBR Snake River Area Office East, Jackson, WY) Area Office Study Leader and boat pilot • Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO, survey leader and EDM operator) • Jennifer Bountry (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), fathometer operator • Ralph Klinger (Geologist, USBR Technical Service Center, Denver, CO), geomorphic mapping • Allen Lockhart (Geologist, USBR Pacific Northwest Regional Office, Boise, ID), landslide debris fans measurements • Steven Bowser (Environmental Engineer, USBR Technical Service Center, Denver, CO), installation of temperature (air and water) data loggers • T. Ed Beddow (Wildlife Biologist, USBR Technical Service Center, Denver, CO), vegetation mapping
Equipment: <ul style="list-style-type: none"> • Large inflatable raft (Snake River Area Office East, Jackson, WY) • Small inflatable raft (Idaho Department of Fish and Game, Idaho Falls, ID) • Catoraft (rented in Idaho Falls by Snake River Area Office East) • Total station survey instrument (USBR Ephrata Office, Ephrata, WA) • Handheld radios (USBR Ephrata Office, Ephrata, WA) • Raytheon Fathometer (USBR Technical Service Center, Denver, CO) • Portable generator, and other miscellaneous supplies (USBR Technical Service Center, Denver, CO)

Table C-7.—Field review from Spring Hollow to upstream end of borrow ponds.

Dates: July 24, 1998
River flow at USGS gaging station near St. Anthony, Idaho (13055000): <u>1,140 ft³/s</u>
Participants: <ul style="list-style-type: none"> • Dick Bauman (Environmental Specialist, USBR Snake River Area Office East, Jackson, WY) • Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO) • Dean Ostenaar (Geologist, USBR Technical Service Center, Denver, CO) • Ralph Klinger (Geologist, USBR Technical Service Center, Denver, CO) • Brent Carter (Supervisory Geologist, USBR Pacific Northwest Regional Office, Boise, ID) • Allen Lockhart (Geologist, USBR Pacific Northwest Regional Office, Boise, ID) • Bill Schrader (Fishery Biologist, Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID)

Horizontal Datum Conversion

In a previous study, a set of 1972 contour maps (based on 1972 aerial photographs) were used to display interpretations of landslides that occurred prior to the failure of Teton Dam (predam), during the reservoir filling, and after the failure of the dam (Magleby, 1981). These maps provided the original control network used to survey the existing conditions data between Spring Hollow and Teton Dam. While these maps worked well for displaying predam landslide interpretations, they did not work well for displaying post-failure interpretations or any of the new existing conditions survey data collected because after the dam failure the topography in the canyon was altered significantly. To provide a new base map that represents existing topography in the canyon rather than predam topography, a set of contour maps based on 2000 aerial photography are anticipated to be developed.

In order to develop the new existing conditions contour maps and present all of the project data in a consistent modern datum, the control network along the canyon rim was resurveyed using survey-grade Global Positioning System (GPS) units in June 1999 (table C-9). Based on this new survey, it was determined that the 1972 predam contour maps were in a local horizontal and vertical datum. The GPS survey of the rim provided data which was used to develop horizontal conversions from the local datum to NAD '83 (table C-8).

Table C-8.—Datum conversions from the predam 1972 topographic map to NAD '83.

Original 1972 control network to Idaho East NAD '27 and NAVD '29 datum			Idaho East NAD '27 and NAVD '29 to Idaho East NAD '83 and NAVD '88		
Northing (feet)	Easting (feet)	Elevation (feet)	Northing (feet)	Easting (feet)	Elevation (feet)
-200.5	-163.8	see figures C-1 and C-2	-22.9	+155952.5	see figures C-1 and C-2

Table C-9.—Control point survey for 1997 aerial photograph rectification and resurvey of control network in modern datum.

Survey task: Control point survey for 1997 aerial photograph rectification process used to develop the new existing conditions contour map and resurvey of existing control network along the canyon rim to provide datum conversions from the 1972 contour map data to the modern datum.
Dates: June 1999
Participants: <ul style="list-style-type: none"> • Cory Stolsig (Supervisory Land Surveyor, USBR Ephrata Office, Ephrata, WA) GPS survey • Sam Trachsler (Surveyor, USBR Ephrata Office, Ephrata, WA) GPS survey crew • Irving Lawyer (Surveyor, USBR Pacific Northwest Regional Office, Boise, ID) GPS survey crew • Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), GPS survey crew
Equipment: <ul style="list-style-type: none"> • Survey grade Global positioning system (GPS) survey instrument (USBR TSC, Denver, CO and Ephrata Office, Ephrata, WA) • Handheld radios (USBR Ephrata Office, Ephrata, WA)

Vertical Datum Conversion

Across the river channel (water surface elevations), 5-foot contour lines were pulled off the 1972 maps and assumed to be in a NAVD '29 datum. These vertical water surface elevations were converted to a NAVD '88 datum and plotted by river miles from Teton Dam with measured existing conditions water surface elevations from Spring Hollow to Canyon Creek. Because the river discharge of 1,400 ft³/s recorded during the 1997 survey is approximately twice the discharge that the 1972 topographic maps were based on, the hydraulic model was used to adjust the 1997 water surface elevations down to the lower discharge of 739 ft³/s for comparison.

Figure C-1 shows the water surface profiles generated by HEC-RAS for the existing conditions at 739 ft³/s and the original water surface profiles pulled from the 1972 contour maps (5-foot contours assumed to be NAVD '29 and converted to NAVD '88 datum). Note that the 1972 contours are only measured at 5-foot changes in elevation. Therefore, the water surface profile between any two contours may not be a straight line as shown, but more of a pool, riffle scenario.

Because of the higher discharge and the landslide constrictions, the water surface elevations measured in 1997 should be equal to or higher than the water surface elevations on the 1972 topographic maps, even in reaches unaffected by landslides. The only exception is the river channel upstream of Linderman Dam. In 1972, this dam was in operation and created a pool that backed up water to the upstream end of pool 15, and a 10-foot drop in water surface elevations across the dam. Today, the drop in water surface elevation across the remaining portion of the dam is only 2 feet.

The comparison showed that the relative 5-foot elevation difference between the 1972 contours appeared to be correct, but the water surface elevations did not match up with the measured water surface elevations as expected. There were 3 specific places where the river channel and water surface elevation is estimated to not have changed. These areas include downstream of the last rapid formed from a 1976 landslide near the confluence with Canyon Creek, in a chute of riffles upstream of pool 24 that did not have any 1976 landslide activity, and near the location of Spring Hollow where a drop in water surface had existed prior to the dam failure due to an island formation. In addition, the water surface could be estimated at the top of pool 15 to match existing conditions because of observations about Linderman Dam operations in 1972.

In these four areas, the 1972 contours were shifted to match the existing water surface elevations. In between these four areas, a weighted shift was applied to maintain the relative 5-foot elevation difference between contour lines while shifting the contours to match the NAVD '88 datum. A hydraulic model was developed to estimate the predam water surface. The existing channel geometry was adjusted based on field observations and aerial photograph comparisons of predam versus post-failure conditions. The computed predam water surface was also plotted in figure C-1 with the measured water surface elevations and shifted 1972 contours. The 1972 contours were used to calibrate the predam hydraulic model to match water surface elevations.

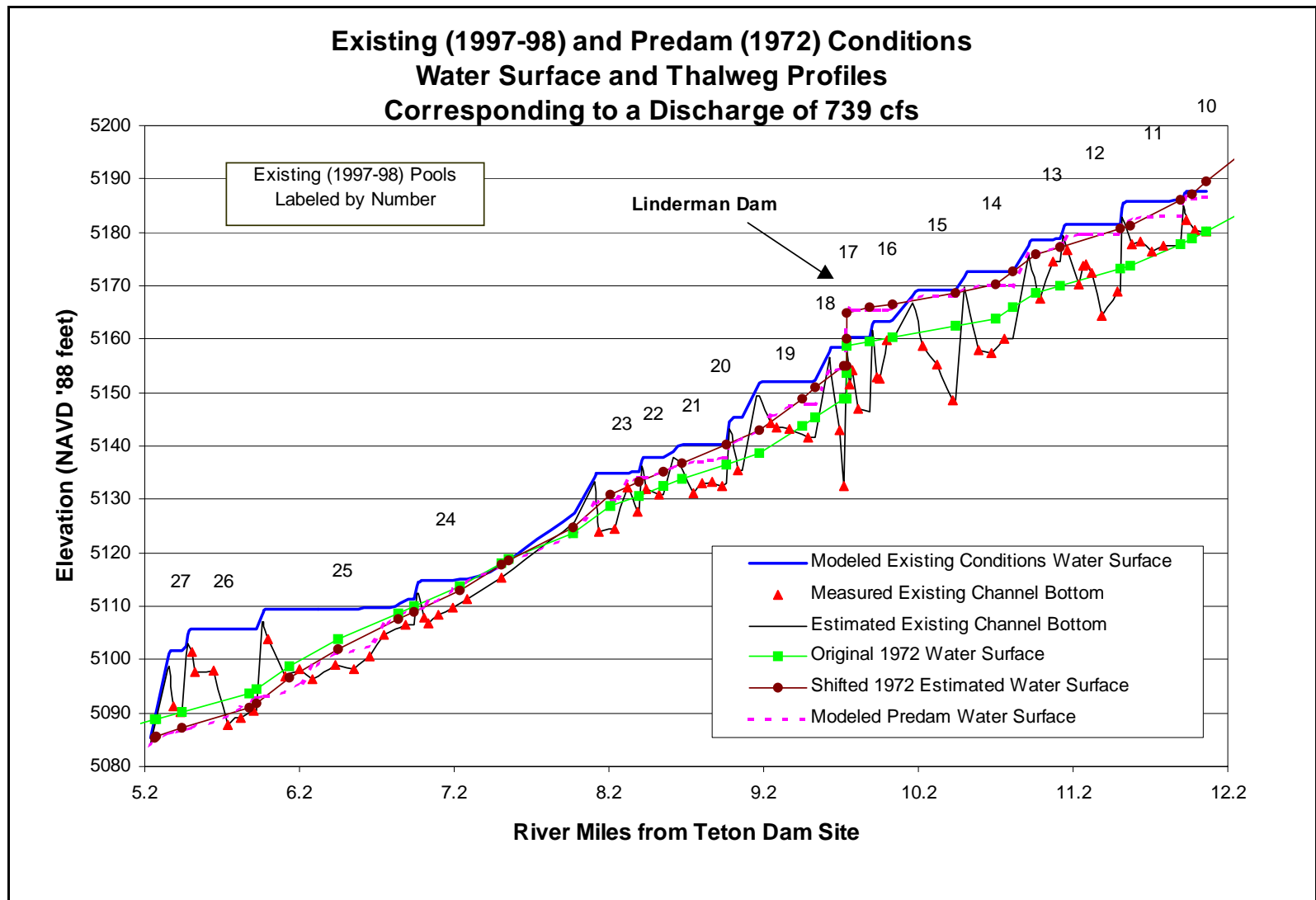


Figure C-1.— Conversion of 1972 5-foot contours to NAVD '88 datum in the Spring Hollow to Canyon Creek reach of the Teton River.

This same approach of shifting the 1972 water surface elevations was used in the Bitch Creek to Spring Hollow reach to convert the local vertical datum to NAVD '88. In this reach, the upstream end of the first pool backed up by a 1976 landslide formed rapid and at Spring Hollow the water surface elevations are estimated to not have changed since the dam failure. The shifted 1972 water surface contours were also plotted with measured water surface elevations and used to calibrate the predam hydraulic model (figure C-2).

Bitch Creek to Spring Hollow Reach Survey

In July 1999, an additional survey was started in the Bitch Creek to Spring Hollow reach to complete the hydrographic coverage of the Teton River canyon in the reservoir inundation area (table C-10). The datum used for this survey was the updated control network in NAD '83 and NAVD '88 developed with GPS during June 1999. Along the rim, GPS units were used during this survey to shoot down positions to each setup in the river canyon rather than a total station as in prior surveys.

For the river channel survey, a similar methodology was used as in the 1997 survey between Spring Hollow and Canyon Creek. However, a different type of total station was used that automatically tracks the horizontal position of the survey raft rather than having to hand adjust the total station for every shot. This method provided more accurate water surface elevations within each pool than the previous method which caused +/- 1 foot fluctuations (see figure 4 in report). The only limitation to this instrument was edge of water shots, previously measured by reflecting a signal off rocks along the edge of the channel, could not be done. For development of cross section lines, it was estimated that the last point in each survey line was approximately 15 feet from the edge of water during the survey.

The logistics of accessing and navigating this reach of river are difficult and caused delays during the July 1999 survey resulting in only a portion of the survey being completed. Therefore, in September 1999 a supplemental survey using the same methodology as in July 1999 was completed to finish the hydrographic survey in this reach (table C-11).

Because the majority of data was collected in September and the river flows were higher in July than September, the average water surface elevations in each pool for the July data was lowered to the average water surface elevation in the corresponding pool for September to provide a consistent data set correlated to a single river flow.

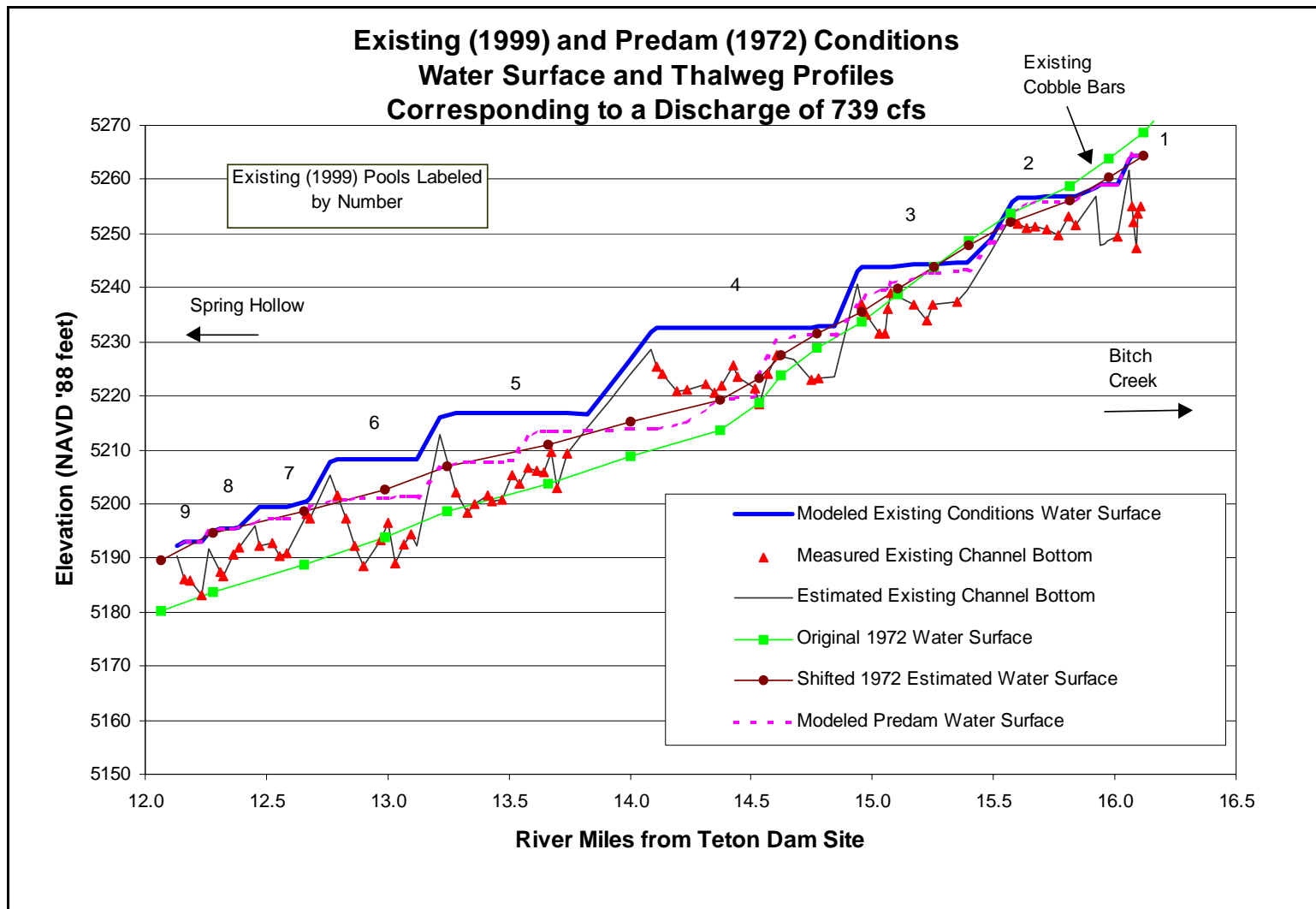


Figure C-2.—Conversion of 1972 5-foot contours to NAVD '88 datum in the Bitch Creek to Spring Hollow reach of the Teton River.

Table C-10.—Hydrographic survey of river channel from Bitch Creek to Spring Hollow.

Survey task: Hydrographic survey of river channel from Bitch Creek to Spring Hollow.
Dates: July 13-15, 1999
River flow at USGS gaging station near St. Anthony, Idaho (13055000): <u>1,660 ft³/s</u>
Participants: <ul style="list-style-type: none"> • Cory Stolsig (Supervisory Land Surveyor, USBR Ephrata Office, Ephrata, WA) survey party chief and instrument operator in the canyon • Sam Trachsler (Surveyor, USBR Ephrata Office, Ephrata, WA) survey crew along canyon rim • Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), boat and fathometer operator • Jennifer Bountry (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), boat and fathometer operator • Marijo Camrud (Hydrologist, USBR Technical Service Center, Denver, CO), data collection aid • Jena Hickey (Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID), data collection aid • Gary Kraus (Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID), survey crew aid • Volunteers (Idaho Department of Fish and Game, Upper Snake Region, Idaho Falls, ID), boat pilots
Equipment: <ul style="list-style-type: none"> • Large inflatable raft (Snake River Area Office East, Jackson, WY) • Cataraft (USBR Technical Service Center, Denver, CO) • Total station survey instrument (USBR Ephrata Office, Ephrata, WA) • Handheld radios (USBR Ephrata Office, Ephrata, WA) • Raytheon Fathometer (USBR Technical Service Center, Denver, CO)

Table C-11.—Hydrographic survey of river channel from Bitch Creek to Spring Hollow.

Survey task: Supplemental hydrographic survey of river channel from Bitch Creek to Spring Hollow.
Dates: September 21-23, 1999
River flow at USGS gaging station near St. Anthony, Idaho (13055000): <u>670 ft³/s</u>
Participants: <ul style="list-style-type: none"> • Cory Stolsig (Supervisory Land Surveyor, USBR Ephrata Office, Ephrata, WA) survey party chief and instrument operator in the canyon • Sam Trachsler (Surveyor, USBR Ephrata Office, Ephrata, WA) survey crew along canyon rim • Clint Anderson (Surveyor, USBR Ephrata Office, Ephrata, WA) survey crew along canyon rim • Tim Randle (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), boat and fathometer operator • Jennifer Bountry (Hydraulic Engineer, USBR Technical Service Center, Denver, CO), fathometer operator • Teton River Guides (Hyde Outfitter, Jackson, WY), boat operators
Equipment: <ul style="list-style-type: none"> • Catarafits (Hyde Outfitter, Jackson, WY) • Cataraft (USBR Technical Service Center, Denver, CO) • Total station survey instrument (USBR Ephrata Office, Ephrata, WA) • Handheld radios (USBR Ephrata Office, Ephrata, WA) • Raytheon Fathometer (USBR Technical Service Center, Denver, CO)

Table C-12.—Control network for Teton River surveys.

Control Point Number	Easting NAD '83 (feet)	Northing NAD '83 (feet)	Elevation NAVD '88 (feet)	Description
Bitch Creek to Spring Hollow Reach Along Canyon Rim (RM 17 to 12)				
30	881792.60	823785.70	5872.08	5/8" Rebar
31	881577.70	824093.80	5956.57	5/8" Rebar
32	878906.00	825001.60	5795.46	5/8" Rebar
33	878501.00	825224.80	5791.26	5/8" Rebar
34	878052.40	825956.10	5792.83	5/8" Rebar
35	877604.20	827533.20	5800.62	5/8" Rebar
36	876083.20	829984.90	5717.70	5/8" Rebar
37	871701.40	831954.70	5607.14	5/8" Rebar
38	872657.00	831034.30	5683.40	5/8" Rebar
Bitch Creek to Spring Hollow Reach Along River Channel (RM 17 to 12)				
50	881858.50	822290.10	5275.05	Mag Nail in Rock
51	882031.70	822911.80	5257.96	Large Nail
52	881276.50	822836.60	5261.11	Mag Nail in Rock
53	879776.90	824086.00	5251.23	Large Spike
54	877933.40	823554.20	5258.54	Large Spike
55	877052.90	825198.90	5266.55	Large Spike
56	876905.00	826732.20	5240.15	Large Spike
57	876282.40	827949.10	5231.63	Large Spike
58	873737.20	829241.30	5227.17	Large Spike
59	878547.60	824201.50	5243.84	Large Nail
60	871772.30	828773.40	5237.84	Large Nail
61	875590.60	829606.40	5221.52	Large Nail
62	871728.40	830542.00	5204.92	Large Nail
63	870923.40	832004.40	5193.73	Large Nail
Spring Hollow to Canyon Creek Reach Along Canyon Rim (RM 12 to 5)				
5005	870862.30	833041.60	5602.93	Large Spike

Control Point Number	Easting NAD '83 (feet)	Northing NAD '83 (feet)	Elevation NAVD '88 (feet)	Description
5006	865610.30	830098.40	5715.82	Large Spike
5012	858939.50	824873.50	5628.45	Set Rebar
5014	856819.60	822104.20	5615.10	Set Rebar
5016	848959.50	821145.20	5581.20	Set Rebar
5017	847284.30	820490.80	5586.58	Set Rebar
5018	845833.80	821103.10	5582.91	Set Rebar
Spring Hollow to Canyon Creek Reach Along River Channel (RM 12 to 5)				
6001	870847.50	832258.10	5199.30	Alum Cap on Rebar
6002	869864.90	832419.30	5196.90	Alum Cap on Rebar
6003	868299.30	831340.80	5196.90	Alum Cap on Rebar
6004	866851.30	830240.80	5190.30	Alum Cap on Rebar
6005	865890.10	829419.50	5187.50	Alum Cap on Rebar
6006	864784.90	828000.30	5192.50	Alum Cap on Rebar
6007	864648.90	826919.40	5186.80	Alum Cap on Rebar
6008	862008.40	824960.30	5168.90	Alum Cap on Rebar
6009	860030.50	825296.80	5161.90	Alum Cap on Rebar
6010	858742.50	823736.00	5158.80	Alum Cap on Rebar
6011	857312.80	821659.50	5144.70	Alum Cap on Rebar
6012	855161.70	821034.00	5143.00	Alum Cap on Rebar
6013	852617.40	820010.70	5126.90	Alum Cap on Rebar
6014	850854.60	819254.90	5122.00	Alum Cap on Rebar
6015	846531.40	819309.30	5116.30	Alum Cap on Rebar
6016	844766.40	820725.80	5118.40	X on Rock
6017	844104.90	820476.90	5120.20	Alum Cap on Rebar
Borrow Ponds Area (Just upstream of Teton Dam at RM 1.5 to .4)				
4999	821742.60	819222.50	5055.70	Large Nail
5001	822110.10	819334.80	5059.10	Large Nail
5002	822668.00	819660.20	5054.00	Alum Cap on Rebar

Control Point Number	Easting NAD '83 (feet)	Northing NAD '83 (feet)	Elevation NAVD '88 (feet)	Description
5003	823696.40	821250.90	5058.90	Alum Cap on Rebar
5004	825648.10	821942.30	5065.80	Rebar